

Before the
FEDERAL COMMUNICATIONS COMMISSION
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FEDERAL COMMUNICATIONS COMMISSION
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In the Matter of)
)
Amendment of the Commission's)
Rules to Establish New Personal)
Communications Services)

GEN Docket No. 90-314
ET Docket No. 92-100

To: The Commission

Comments of Apple Computer, Inc.

Apple Computer, Inc. ("Apple"), hereby submits comments on the Notice of Proposed Rulemaking and Tentative Decision ("NPRM") in the above-referenced proceeding. Apple strongly supports the Commission's efforts to foster un-licensed PCS technologies, including Data-PCS, which was the subject of Apple's January 1991, Petition for Rulemaking.¹

INTRODUCTION

The Commission is correct in concluding that allocating spectrum for un-licensed PCS devices will permit the rapid introduction of new PCS technologies, such as Data-PCS, wireless PBXs, wireless telephony office systems, and the multimedia classroom (collectively, "User-PCS").² The Commission's proposals are a major step toward realization of the vision of a new kind of information technology — a vision that prompted Apple to file its Data-PCS Petition. The discussion that follows focuses on the remaining steps that must be taken to make that vision an immediate reality. By focusing on what remains to be done, however, Apple does not intend to diminish the magnitude of the Commission's achievement in making this beginning.

The anticipated growth in new un-licensed PCS technologies is dependent upon the amount of spectrum that the Commission allocates to the un-licensed services, the

¹ Apple's Petition for Rulemaking, RM 7618 ("Apple Petition") now has been consolidated in the instant proceeding, Gen. Doc. 90-314.

² See NPRM at ¶42.

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amount of time it will take to clear microwave operations from that spectrum, and the technical rules that will apply to use of the spectrum. Measured against this standard, the growth of User-PCS will be delayed at best and jeopardized at worst, if the Commission's proposal is adopted in its present form. In brief, the Commission has not allocated sufficient spectrum to un-licensed PCS and has not yet accepted the necessity, or full implications, of clearing microwave facilities from the frequencies designated for un-licensed PCS.

In addition, the Commission's proposed technical rules are unresponsive to the anticipated dynamics of un-licensed PCS applications and technologies. Those proposals are based on the unwarranted assumption that there can be co-primary sharing between the un-licensed services and microwave users and are, therefore, intended to minimize interference between the two uses. Once the impossibility of co-primary sharing is accepted by the Commission, the Commission can allow an industry committee sufficient scope to develop detailed technical requirements for un-licensed PCS. In this way, manufacturers will have sufficient technical flexibility to market a wide array of new designs and technologies to meet consumer needs.

Apple, as a participant in WINForum and the IEEE 802 Local Area Network Standards Committee, supports and will not repeat the positions stated in the comments filed in this proceeding by those organizations. Other than specifically endorsing and emphasizing the need documented by WINForum and the IEEE Committee for substantially more spectrum for un-licensed PCS than the 20 MHz proposed in by the Commission, Apple will comment only on certain aspects of the Commission's proposal.

DISCUSSION

I. The Commission Should Create A Spectrum Reserve To Accommodate The Mix Of Services And Service Providers That Could Use The Un-Licensed Frequencies.

The Commission has proposed that permitted uses of the un-licensed PCS spectrum be confined to cordless telephones, including wireless PBX systems, and data communications between computer systems.³ While cordless phones systems are defined elsewhere in the Commission's Rules,⁴ it is virtually impossible, and probably

³ See NPRM, App. A §15.253.

⁴ 47 C.F.R. §15.3(j).

self-defeating, to define narrowly the terms "wireless PBX" and "data communications between computer systems."

The definitional dilemma created by not wanting to define access to the un-licensed spectrum too narrowly, however, creates a risk that the un-licensed spectrum could become fully consumed by parties trying to bypass the licensed PCS services and to avoid the cacophony of transmission powers and modes that have rendered un-licensed use of the 902-928 MHz ISM frequencies a radio Tower of Babel.⁵ This "bypass" risk will be particularly great, if, as anticipated, the un-licensed PCS spectrum is allocated and available for use before the licensed PCS spectrum is available.

Apple is not necessarily opposed to expanded uses of the un-licensed frequencies. It is by no means obvious that value judgments, or even clear definitional distinctions, can or should be made between valid and invalid uses of those frequencies. What is clear, however, is that the Commission's intentions are to provide spectrum for the User-PCS applications described in the filings of Apple, WINForum, and many others. Indeed, the need for User-PCS merits an immediate allocation of some 20 to 45 MHz more than the Commission has proposed. Even with such an additional allocation, the un-licensed PCS spectrum would not satisfy the needs both for User-PCS and for the multitude of additional uses that would be created by the pent-up demand for PCS spectrum.

If such additional uses of the un-licensed frequencies are to be allowed in lieu of, in addition to, or in advance of, licensed PCS spectrum being available, the Commission must take this into account in deciding how much spectrum to provide initially for un-licensed versus licensed PCS and how much to leave in reserve. Apple urges not only that more spectrum be allocated to un-licensed use at the outset, but that a substantial reserve be created. A reserve would allow the Commission sufficient flexibility to increase the un-licensed PCS spectrum if, despite the effort to limit access to the spectrum for certain defined uses, that spectrum becomes home to an open-ended variety of un-licensed services.

⁵ The WINForum Spectrum Etiquette cannot be relied on to limit access to the unlicensed frequencies only to those devices eligible under FCC rules. The Etiquette is intended only to constrain all User-PCS devices to a known transmission behavior pattern. If some device that is not a cordless phone, wireless PBX, or a computer follows that behavior pattern, the Etiquette is satisfied, even though millions of other types of radio transmitters are operating on the band. In short, all that the Etiquette can accomplish is to avoid the wildly disparate transmission modes that now characterize unlicensed operation on the 902-928 MHz ISM frequencies under Part 15 and make those frequencies unusable for applications such as Data-PCS (see Apple Petition at 13-15).

II. Un-Licensed PCS Devices Cannot Share Frequencies On A Co-Primary Basis With Microwave Users Because Of The Interference Susceptibility Of Microwave Receivers And The Mobility Of Un-Licensed PCS Devices.

As the Commission knows, Apple and other companies are participating, through WINForum, in the development of a Spectrum Etiquette to permit user-provided voice, data and mixed media systems to collaborate in using a finite amount of spectrum. The Etiquette is based on sharing techniques, including data packetization and recontention for access to the transmission medium, that conventionally are used to enable intensive sharing of wired computer networks, along with special provisions to meet some unique requirements of voice systems.

User-PCS devices cannot avail themselves of an etiquette to share with fixed microwave services who have co-primary, or even secondary, status. Yet, the FCC has proposed that un-licensed PCS technologies share frequencies on a co-primary basis with the existing microwave users of the 2 GHz band. Microwave receivers are very susceptible to interference and, in view of the mobility of un-licensed User-PCS devices, it would not be possible to assure that the microwave receivers would not receive unacceptable interference from such devices.

Given the sensitivity of microwave antennas, they do not provide complete discrimination against an interfering signal at any axis, despite the fact that the antennas are relatively directional. For this reason, microwave links are coordinated to assure that no interfering signal can arrive at the receiver's antenna terminal from another link above a specified threshold. It is, of course, impossible to achieve such careful coordination in real time with un-licensed PCS devices that are, by design, capable of being used anywhere.

Figure A (below) shows the area (shaded) in which an un-licensed PCS transmitter could generate an unacceptable interfering signal to existing microwave receivers in the 1890-1930 MHz channels in the vicinity of Houston.⁶ Note that the interference area created by a single PCS device to a single microwave link on the same frequency can be tens of square miles. (Obviously the area of threat could be larger if the PCS device were on an upper floor of a building, or smaller if there were intervening obstacles.)

⁶ This example is based upon a 100 mW PCS transmitter, six feet above the ground, and areas in which the link receivers are vulnerable to interference from the device are based upon their actual heights.

III. In Order To Facilitate The Rapid And Cost-Effective Implementation Of User-PCS, The Commission Should Explore Methods To Accommodate A Large Proportion Of Microwave Users Within The 2 GHz Bands.

Apple recognizes that, ultimately, fixed microwave users must be relocated outside the Emerging Technologies Bands, as the Commission has stated. Although there are many studies that demonstrate that there is a substantial amount of unused spectrum in the 1850-1990 MHz band in a very large portion of the country, there is no consistency from location to location as to which exact frequencies are unused. Yet, it is essential that the same frequencies be available for un-licensed use at all locations.

Given the need to provide assurances to existing microwave users that their service will not be damaged or even threatened, it would take many years and many millions, or even billions, of dollars to clear 20 to 65 MHz of spectrum for un-licensed use and relocate and guarantee continued service quality to present microwave users.⁷ A relocation plan that addresses only migration to 6 GHz frequencies, therefore, would delay or even prevent development of User-PCS.

It is vital that User-PCS be deployed much earlier than would be possible under the mass-relocation schemes now being considered. Apple believes that there are innovative, but well proven, methodologies that can be employed to accommodate a larger proportion of microwave users in the 2 GHz band and yet provide spectrum for User-PCS that is cleared of fixed microwave users. The methodologies involve a combination of:

1. Leaving some stations in their present channels for the duration.
2. Reassigning some stations to different channels within the present 1850-1990 MHz bands according to a frequency-optimization plan.
3. Relocating a very limited number of stations, nationwide, to the 6 GHz band.
4. If the alternative is available, re-accommodating some small set of stations within the federal government's 1710-1850 MHz band.

⁷ It appears that there are many more than the 28 microwave receivers even in the 20 MHz that the Commission has designated for un-licensed PCS use. WINForum estimates that almost 2500 microwave stations would have to be relocated to clear 50 MHz for un-licensed use, including the 20 MHz identified by the FCC.

To the extent that microwave stations remain in the same 1850-1990 MHz band that they presently use, or even the 1710-1850 MHz band, one of the major uncertainties of relocation to 6 GHz (that of the effects of propagation on reliability) is resolved. At a cost that would be only a fraction of that required for 6 GHz relocation, and in a correspondingly short time interval, an initial clearing of a substantial amount of spectrum can be accomplished.


Apple believes that methodologies such as those described represent the most favorable means of providing for User-PCS in the short term. The financial cost of carrying out the process to meet the short term need is minimal compared with the social and financial benefits that would be gained. In fact, only by providing immediately for widespread deployment of User-PCS can a substantive financial and marketplace basis be established for further, time- and money-intensive relocation to 6 GHz, as will be ultimately required and as has been proposed by the Commission.

CONCLUSION

The Commission correctly has concluded that it should act expeditiously to conclude this proceeding "because unnecessary delay could threaten the U.S. leadership role in communications technology."⁸ An equal justification for swift Commission action is that U.S. consumers and manufacturers both eagerly await the opportunities that lie ahead when Data-PCS and other new information technologies are made a reality.

Respectfully submitted,

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⁸ See NPRM at ¶139.

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